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AN ACCOUNT
OF THE
Forests of Russia and Their Products
IN COMPARISON
WITH THE TOTAL TERRITORIAL AREA
AND WITH
THE POPULATION.

BY
P. N. WEREKHA,
Member of the Forestry Society of St. Petersburg.

1873.

(TRANSLATED BY A. KIRKWOOD.)



TORONTO:
WARWICK BROS. & RUTTER, PRINTERS, & CO., 68 AND 70 FRONT STREET WEST.
1896.



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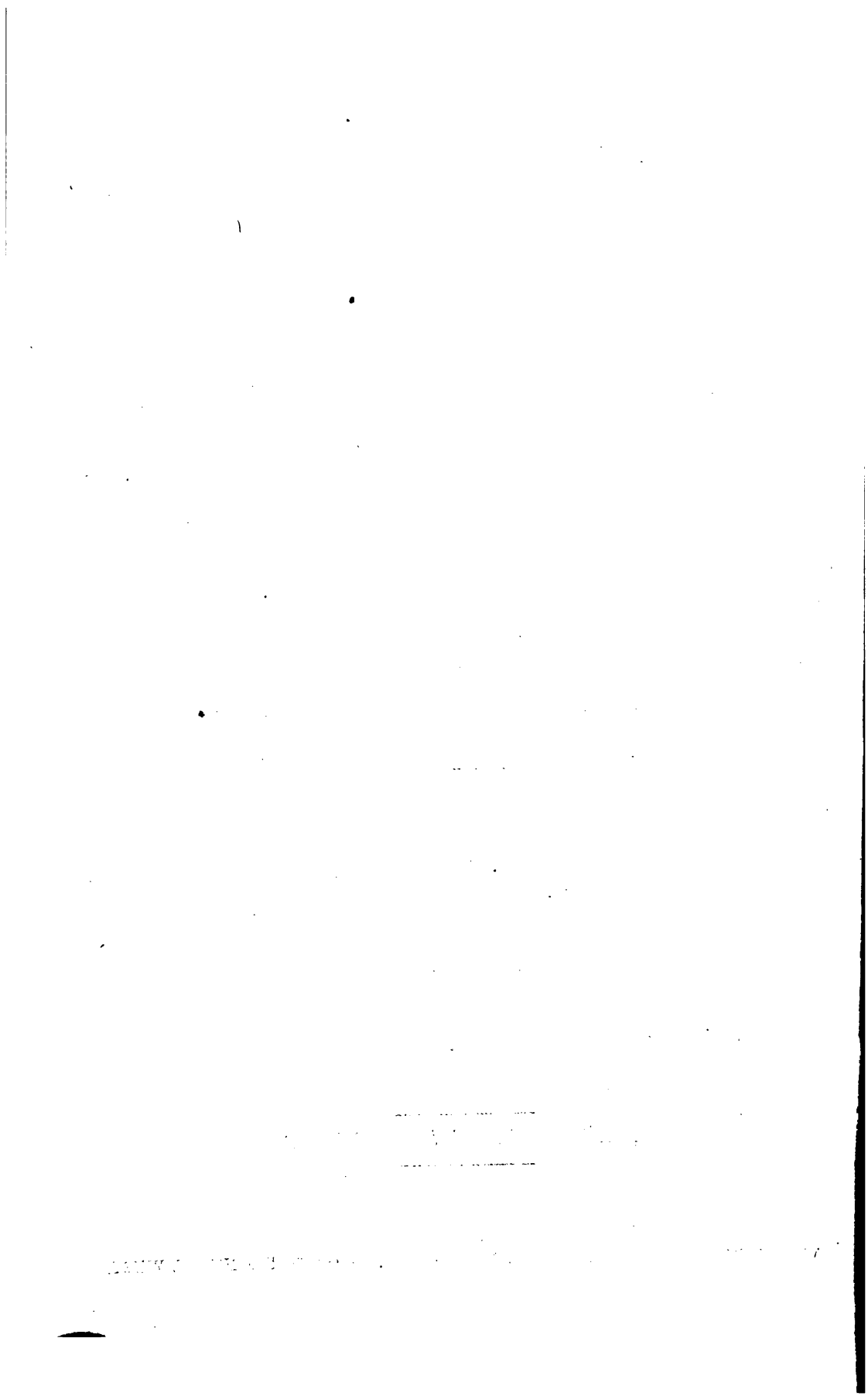
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AVANT PROPOS.

It is the duty of the State to manage and exploit the public forests, systematically, by a trained staff of scientific officers and skilled workmen ; and to encourage the development of their industrial resources.

The forests of Russia, exclusive of those of Central Asia, Caucasia and Finland, extend over a space of 177,159,000 square déciatines, or 193,544,105 hectares,* corresponding to nearly 40 per cent. of the total superficies of the Empire in Europe. Comparing the extent of country occupied by the forests with the number of inhabitants, there are about 2.03 hectares to each inhabitant.

If the proportion between the extent of forests and the population was everywhere uniform, it might be said that the requirements of the country were more than completely assured ; but in Russia the forests are very unequally distributed ; so that of the whole area of the forests there are 97,930,000 déciatines, or 106,964,797 hectares situated in the four governments of the north : Arkhangel, Vologda, Olonetz and Perm ; which make about 65 per cent. of the total superficies of the forests and more than 26 déciatines (28,398 hectares) for each inhabitant. In the ten most thickly populated governments in the centre of Russia, those of Moscow, Riazan, Penza, Kalouga, Toula, Tambow, Orel, Koursk, Voronège and Kharkow, the forests occupy only a space of 7,938,000 déciatines, or 8,670,330 hectares, which make about 18 per cent. of the total area, and scarcely half a déciatine or 54 ares for each inhabitant. In the seven governments of the south : Bessarabia, Kherson, Ecaterinoslaw, Taurida, Podolia, Poltava and Astrakhan, these proportions are still much less. In these seven governments of the south the wooded lands (1,795,000 déciatines, or 1,960,602 hectares) represent only $3\frac{1}{2}$ per cent. of the total forest area and not more than 0.1 déciatine or 11 ares to each inhabitant. The very dense population of the ten governments of the Kingdom of Poland, which occupy a space of 122,266 square kilomètres, has, altogether, 3,053,000 déciatines or 3,334,663 hectares of forest, making 22.27 per cent. of the total area. In these ten governments there is but one-half a déciatine, or only 54.56 ares of forest to each inhabitant.†

Such an unequal disposition of forests, as well in regard to the total forest area of the Russian Empire in Europe, as to the population ; the immense distances that separate the thinly wooded governments of the south ; the rich forests of the northern governments ; the want of water communications between many localities ; and the cost of carrying wood long distances by rail ;—all these circumstances have compelled the inhabitants to seek methods of reforestation,

* 40 hectares=99 acres, nearly.

1 déciatine=109,248813495843894 ares.

† 1 are=119.6 square yards.

as well for building purposes as for fuel. And all the while, the people of the wooded districts of the north suffer more as they do not profit from their abundance of forests, because they obstruct the communication between localities so thinly populated.

As to territorial ownership the forests are distributed as follows :

The state forests occupy 110,726,000 déciatines or 120,966,840 hectares.

Forests appertaining to the mines of the Crown occupy 5,394,000 déciatines or 5,892,880 hectares.

The appanage forests of the Crown extend over 5,487,500 déciatines or 5,995,028 hectares.

Forests appertaining to towns, churches, monasteries, different institutions and private individuals extend over 55,551,500 déciatines or 60,689,354 hectares.

Private individuals and institutions owning forests have the absolute right to cut the timber and clear them up. It follows from this that all calculations and guarantees as to the future forest wealth of the country can only be based on those forests which are under the immediate guardianship of the Government, or special forest administration. This is why the guarantee of the needs of the population in forest products and traffic really depends upon the administration of the state forests by the Government.

Of the whole extent of the forests of Russia, the most considerable part, as well of the state forests, as those belonging to individuals, is situated in the northern governments. In Arkhangel the state forests represent 41 per cent. of the whole forest domain ; in Vologda, 82 per cent. ; in Olonets, 86 per cent. ; in Perm, 43 per cent. ; in the centre the proportion is 10 per cent., and in the south it is below 1 per cent.

VARIETIES OF TREES AND THEIR USES.

Russia in Europe, with few exceptions, possesses all the trees indigenous to western Europe. The principal of these that are the object of forest management, are the following :

The wild pine (*Pinus Sylvestris*). In the north, this variety pushes almost to the limit of vegetation. To the south, having been subjected to prolonged destruction for several centuries, the limits of its growth have gradually receded towards the north, and now form a broken line setting out to the west of Volhynia in the district of Ostrojki, about the 50° of north latitude. From there towards the south, the limit of vegetation cuts the Government of Kiew, Poltava and Kharkow, and falls in this last government to the basin of the Don, about the 49° of latitude. Farther on, the southerly limit of its growth turns sharply to the north of the Don, cuts the governments of Koursk, and of Orel on the Oka, crosses the Government of Kalouga, scarcely touches the Government of Toula, especially in the districts of Alexinsk and Bielewsk, describes a curve

round Toulá, and by way of Riazan and Tambow, descends to the district of Bobrowsk, in the Government of Voronega, thence across the governments of Tambow, Penza, Saratow, Simbirsks, Samara and Orenbourg, extends to the Oural, cutting the river about the 51° of north latitude. In Russia this pine forms compact masses in many places, particularly on healthy lands and gravel, called Bór, or pine lands; but also grows freely intermixed with birch, or spruce, or larch, or poplar, and other species.

This pine is chiefly used for building purposes, as beams, planks and boards. A large trade in these materials is carried on between Germany, France and England. The pine for these markets comes from the Governments of Olonets, St. Petersburg, Tver, Novgorod, Orel, Smolensk, and the northern governments, and is known by the name of Riga pine. Large dimension pine is used for the masts of vessels and in the construction of ships for sea and river navigation, and very considerably for railway ties. Its use in the manufacture of casks is also of some importance. All the resin dispatched from the northern governments abroad, as well as that sold in the markets of the interior of the Empire, is carried in barrels made of this wood. It is also used in the manufacture of small wares and in carpentry, but in this respect it gives way to harder species of wood, as the oak, the ash, the maple, the birch and other broad-leaved kinds. In the peasants' houses of the north countries this pine, cut in thin boards and re-split is used in the manufacture of matches. Inferior qualities are used for firewood. The stumps, roots and knots make tar, pitch and turpentine, commercial articles for home use and export. For construction purposes this pine is exploited by cuttings from 100 to 150 years old, and by cuttings of about sixty years for fuel.

The Red Spruce fir (*Pinus Picea*: Lin. *Pinus abies du Roi*). This is the European spruce (*Picea Europæa*), which Ledebour distinguishes from the *Picea obovata*, which extends on this side and beyond the Oural, and is, in reality only a variety of the *Picea Europæa*. The northern limit of growth of the spruce is the same as that of the other Coniferæ. Its southern limits coincide with those of the pine; but in consequence of the destruction of the forests it has pushed back to the north in many places. Its southern limit, like that of the pine, commences on the west in the Government of Volhynia. Steering towards the east it cuts the Government of Kiew, and the northern part of Tchernigow, enters into Kharkow, turns like the pine into Toulá, crosses Riazan, Tambow and Saratow, and scarcely touches Penza; then bends by the Volga and the Kama, towards Oufa, then straight to the east to the chain of the Oural mountains.

The spruce is generally consumed in the interior of the country. Girders, joists and rafters are exported in inconsiderable quantities, and some boards, by Baltic and Black sea ports. In the interior of the country, in many districts, spruce is used in place of pine, for building purposes, and, although it does not

possess the solidity of pine, it is used by the middle classes because it is 35 per cent. cheaper. Spruce, like pine, is used in considerable quantities in the manufacture of laths and battens, and shingles. The roots, forming almost a right angle with the trunk of the tree, are made use of, in considerable quantities, as knees in the construction of river boats. For this purpose the trees are rooted up without being cut. In some localities the stumps, the roots and also the trunk are mixed with those of pine for the extraction of resin; but this medley considerably alters the quality of the product, and the tar obtained is used for greasing the wheels of the peasants' carts. It is not so very long ago that, for the purpose of extracting tar from spruce, it has been treated, in some localities, in the same manner as pine. This process is the same as that introduced under the administration of Colbert in 1658 by Swedish instructors in the Landes of France, for the gemmage and fabrication of tar from the maritime pine.

For the purposes of fuel spruce was used as well as pine, but being less valuable than pine, it was about 3 per cent. cheaper where it was cut in the woods. Spruce bark, in the northern governments, takes the place of lime-tree bark for the sheating of wagons and sledges; as a material for tanning, the bark is largely used in localities where willow or other trees richer in tan are scarce. Large forests are frequently entirely composed of this species of tree, especially in moist and argillaceous soils, but it is often mixed with other kinds of wood, as pine, birch, poplar, and in the north with the white spruce of Siberia. Spruce is exploited in the same order of cutting as pine. Siberian spruce (*Abies-Sibirica*), Ledeb (*Abies Picta*), Forbes, forms forests mixed with common spruce, and pure, grand, massive forests, in some places, in the north and north-east, and beyond the Oural. Technically, the Siberian fir is equal in value to the European or silver fir, and is exploited in a similar manner, in the true light of economic forestry. The European fir (*Abies taxifolia*, or *A. pectinata*) flourishes in the western governments, near the Carpathian mountains.

The Siberian Larch (*Larix Sibirica*) extends over the north-east part of Russia in Europe, and farther in an eastern direction. Its limits to the west and south are denoted by a line commencing a little west of the Bay of Onega, on the White Sea, thence south to the district of Kargopol in the Government of Olonets, and easterly across Kostroma to the district of Séménovsk, in the Government of Nijni-Novgorod; then turns the Government of Kazan (where it is only found in isolated patches), cuts the Government of Viatka, and heads towards the Oural, by the northern district of Oufa. Over this expanse of country, almost entirely covered by forests, the supplies of larch are very considerable. Larch is dispatched abroad by the mouths of the Petchora and Mezene, and in the same way to Cronstadt for the uses of the Russian fleet. At present the use of larch is very limited, attributable, in part, to the difficulty of procuring it from ports situated on the Northern ocean. But the remarkable solidity of the wood of this species,

its flexibility, the large dimensions of the trees, and the important fact that the wood of the larch is rarely attacked by insects, all lead to the supposition that as time goes on, the larch will not occupy the last place among woods for naval construction. During recent years the Minister of Marine has taken from the forests of Arkhangel, 100,000 feet, or 2,832 cubic meters of larch annually. The larch in these northern regions grows very slowly, the soil being shale and the sub-soil stony. This is why, if timber of large dimensions is required, these forests can only be exploited at the age of 180 to 200 years. But when larch grows in a marly soil or a calcareous sub-soil its vegetation is much more rapid, and the quality of its wood superior.

The birch (*Betula alba*) is one of the most prevalent forest trees in Russia. Mixed with pine, Norway spruce, silver fir of Siberia, *Pinus cembra* (called also the cedar of the north), birch reaches almost to the limit of northern forest vegetation. It is found on the south at the 45° of north latitude. Isolated trees are found farther south, or groves arising from artificial cultivation. The tree grows in small quantity in the Crimea and the Caucasus, on the northern slopes of mountains, where pine and spruce are usually found. Sometimes it forms forests unmixed with other varieties, sometimes it is mixed with pine, and occasionally with spruce and poplar. Its principal use consists in the manufacture of small pieces of carpentry, as a material in carriage-making, and as firewood, for which purpose it is highly appreciated in Russia. The exterior bark yields by dry distillation the empyreumatic oil of birch, called pure "Diogott"; it is also used for tanning leather, particularly the kind known as Russian leather. The bark used for this purpose is stripped either from felled or standing trees; in the last case the operation is not essentially injurious to the trees, if carefully done without deterioration of the inner bark. In five or eight years the bark is renewed and can be taken from the tree again. Birch bark is also employed in making utensils of different kinds used by the peasantry instead of boxes, baskets and basins for dry articles as well as to hold liquids. In the northern districts, where the linden is not abundant, birch takes the place of the latter in the manufacture of "Lapti," a kind of shoe or slipper made of bark for the peasantry. Although birch bark lasts longer, and is less subject to decay, yet in drying it becomes brittle, and slippers made of it are less solid than those made from the linden or the willow.

Birch is exploited or felled as coppice, and high forest, in revolutions of thirty to sixty years. In forests composed of birch and coniferous trees, the first are exploited in two cuttings, whilst the conifers are cut only once if intended to be used for the purposes of construction.

The linden tree, lime-tree (*Tilia parvifolia*). Commencing in the most southerly countries of Russia, the lime tree is found as far as Saint Petersburg and Lake Onéga. Setting out from there, its northern limits cut the governments of

Olonetz and Vologda by the districts of Solvitchegodsk and Oustsyssolsk, traverse Perm and skip over the Oural, about the 58° of north latitude. Great masses of Linden are found in the governments of Viatka, Kostroma, Nijni-Novgorod, Kazan, Penza and Tambow and the northwest. Forests composed entirely of trees of this species are rarely found; it is usually mixed with oak, birch, poplar and other broad-leaved species, and different kinds of shrubs. The wood is not of any special value. It is used by carpenters, turners and sculptors, and in construction, where other woods cannot be obtained. Its principal value consists in its inner bark, which, taken from trees from five to ten years old, is used in making slippers and plaiting baskets. When twenty years old or more, the bark is macerated and divided into fine ribbon-like filaments which are made into mats and cords and cables up to a certain point, instead of hemp, and cheaper. The whole bark, when pressed, is used for sheathing wagons and sledges, making boxes and roofing houses.

The poplar (*Populus tremulia*) grows throughout the whole of Russia to the 63° of the north latitude. It is not much esteemed, especially where better kinds of wood can be procured, but it propagates easily and grows quickly. It is considered incongruous when growing in woods composed of more valuable species, such as pine, birch and oak, because it is prejudicial to their propagation. Its principal use is for firewood, but even for this it occupies the lowest rank, as well among conifers as the broad-leaved species. Poplar of the best quality, at least half a meter in diameter at the root, is used for making small toys and knick-knacks and utensils turned in the lathe, painted and varnished like Chinese woodenware. In the sparsely wooded districts of the south, poplar is used in construction, and if very dry before it is worked, it yields but little in solidity to spruce and even to pine. In our own time poplar has acquired much importance as a material for the manufacture of paper pulp, being considered most suitable for this purpose on account of the flexibility, lightness and whiteness of its wood. Poplar bark is used occasionally for the fabrication of tar, and is, frequently, for this purpose, mixed with birch bark; but if the product obtained from this mixture is cheaper, it is also of inferior quality. Sabots, or wooden shoes, are made from poplar in the northwest of Russia, perhaps not so solid as those made in France from beech, but much lighter, and, consequently, more comfortable; it is also used to make shingles for the roofs of houses, of one foot in length and four inches wide. Poplar for firewood is exploited by cuttings of thirty and not more than sixty years old. Poplar wood for working should have attained the age of 90 or even 100 years. Felling should not go beyond this age, because at ninety years the heartwood is frequently rotten.

The oak (*Quercus pedunculata*) is found over the whole of Russia, excepting the northern districts. The northern limits commence in the government of Livonia, about the 58° of north latitude, thence a little to the south, traversing

Novgorod, and passing Tver, they run towards the east, pass round the government of Moscow, cut those of Jaroslaw, Kostroma, Viatka and Oufa, and heading towards the frontier of Russia in Asia, cross it near the 53° of latitude. The largest oak forests are found in the governments of Kazan, Simbirsk, Nijni-Novgorod, Minsk, Mohilew, Volhynia and other western localities, and also in the Baltic provinces. In certain localities close, massive woods are found composed entirely of this species of tree, but it is also found mixed with other varieties of broad-leaved trees, and sometimes with pine. This oak attains enormous dimensions; its trunks are straight and its wood distinguished by its excellent quality, and the most precious of all the trees in Russia. The price has increased considerably, since oak forests belonging to individuals in the western governments have been greatly exhausted by excessive cutting. Besides the considerable use that is made of this wood in the interior of the country, there is a large foreign trade particularly with England by the Baltic ports, and with France by the Black Sea. In the docks of London and the market places of Marseilles one may see oak coming from the western parts of Russia every year. These giants sometimes re-visit their country again, not in their rough state, but in the shape of vessels' keels, cable bitts, quarter decks, prows, ribs, side-planks, and other parts of ships. Oak wood is also exported in the form of wainscot-logs, used in England for carpentry, and staves for cooperage. In the interior it is also used in ship-building, carriage-making, and the manufacture of many small articles. In the south, being cheaper, it is used for railway sleepers. Bark from young trees is used in the tanneries, where it is preferred to willow bark and all other kinds, as it contains 16° of tanning material, whilst willow contains scarcely 7° , and spruce still less.

Many other woods are found in Russia besides those already mentioned, as beech, for example, forming entire groves, but only in the more southerly countries of Podolia, Bessarabia, and the Crimea; the horn-beam, in the southwest, and some parts of the northwest; many species of willow are found everywhere; in the southerly governments of Kherson, Ekaterinoslaw, and Bessarabia they form entire forests along the inundated banks of rivers, as the Daunbe and the Dniester. Ash, maple, elm, cedar, white and black alder, poplar, walnut, and many varieties of shrubs are used for many purposes in those districts where other woods do not abound. Winter oak (*Quercus Robur*) is found to the west on an irregular line traced between Kovno, through Mohilew and Kiew to Kischinew; and the *Quercus pubescens* in the Crimea and the mountains of the Caucasus. The limit of the horn-beam (*Carpinus Betulus*) to the northeast runs from Riga to Vitebsk, and thence, almost in a straight line, to the mouth of the Don. The beech (*Fagus Sylvatica*) extends along the frontiers of Austrian Galicia, and a straight line by the side of Moldavia; in the Crimea and the Caucasian mountains it forms very thick and magnificent forests.

TREATMENT AND EXPLOITATION OF FORESTS.

In days gone by the forests were cut under license, and this mode is in vogue at the present time. Systematic cutting goes back only to the time of Peter I. and does not now everywhere prevail.

The old method of *jardinage* exists at present in a great many forests.* This arbitrary manner of cutting and felling no longer satisfies the wants and demands of many localities, where assortments are found to dominate in the forests of the north and northeast of Russia; it gives way in the central and southern parts of the country, according to development and demand, over the whole extent of the forests, to exploitation according to the system of regulated cuttings. The abundance of the forests in the north of Russia, and the little demand for wood are the cause why many of the forests so situated can be exploited by *jardinage* only, to supply the small demands of trade and local wants. It is only in the second half of the last century that people commenced to consider special plans of forest administration, and adopt the method of regular cuttings for their management. By these old plans it was a question of dividing large forest areas, even of high forest, in straight zones, parallel to each other across the whole mass, and equal in number to the number of years of the revolution prescribed for their exploitation. The physical inconveniences and the complete inequality of the yield from these cuttings *a tire et aire* caused the method to fall into disuse, and resulted in the continuation of the arbitrary system of *jardinage*. The rational system of exploitation was introduced into Russia and put into practice in the year 1841. In 1873, of the whole extent of the Government forests, there were 11,872,500 hectares under a system of regular exploitation, principally in the southern, central and southwest provinces, where the forests have acquired great importance, because their extent and yield scarcely suffice for the local wants of the population. The forests appertaining to mines and factories are all exploited according to plans of systematic management, and one may rely that on all these forests which cover a space of 5,891,638 hectares, the cuttings are in just and legal conformity with the annual increase of the trees.

In the forests assigned by the sovereign to his younger sons, there are 3,728,346 hectares, all under systematic management.

As relates to forests owned by individuals, there is no organ containing technical and statistical information, and tending to establish useful and practical methods. Nevertheless in these latter days, forest proprietors, especially large proprietors, strongly recognizing, the utility of placing their forests under a

**Jardinage* is the outcome of primitive exploitation. Where wood abounded, and the forest was open to everyone, each one took according to his needs. So long as exploitations of this kind are restrained, it is possible to proceed by *jardinage* in all the forests. Nevertheless the extraction of trees taken here and there in the interior of massive woods is very unfavorable to the development of broad-leaved species.

regular system of exploitation, have chosen specialists for this purpose, men who, beforehand, have received a technical education on forest administration. Some proprietors may be mentioned whose forests are rigorously managed, conformably to scientific rules, and among others, Prince Paskevitch, proprietor of several large forests in the governments of Mohilew and Riazan; Count Ouvarow, proprietor in the governments of Minsk, Vladimir and others; Prince Youssoupow, Count Tolstoi, Count Strogonow, M. M. Maltzow, Demidow, Schatilow, Scheremetiew, the Countess Ribeaupierre, Count Apraxine, Baron Korff and others. Even in forests belonging to village communities, there have begun to manifest itself here and there some rare efforts of rational management. Of forests belonging to towns, those of Riga and Pernaú are well managed. But in the majority of forests belonging to private owners they cut in *jardinage*, or here and there *a tire et aire* and *a blanc etoc* without any fixed plan of management, according to demand or need of money. The principles governing the organization of State forest management are not rigorously defined, but the best tendency proclaimed since 1841 has begun to prevail—that is to say, exploitation so as to obtain the greatest material product, and most useful for the general interest. The working plans of management determine the duration of the revolution of the cuttings and their situation, the estimate of the volume and value of the cuttings of the first decade; the methods of reforestation or restoring high forest and wood-coppices; the re-wooding of places stripped of trees and lying waste, of useless lands, and the adoption of all local measures for the amelioration of forest growth, advantageous to its exploitation. These works are entrusted to the hands of commissioners of forest organization, who, after having presented to the forest directors the general plan of a forest, with a specification of the work necessary for its management for the first decade, pass to the elaboration of analogous plans in another forest; a similar commission returns towards the end of the first decade to control the execution of the works of management of the first decade, and fix the special plan for the following decade.

The system of exploitation of the forests prevailing in the centre and southern part of Russia consists in cuttings *a blanc etoc* contiguous to one another. The natural reforestation of the large areas denuded by these cuttings by the seed of adjacent masses is too rare, and attempts have been made to introduce in the exploitation of high forest (for the most part very irregular), instead of cutting *a blanc etoc*, the reservation of trees for seeding; but the number and quality of trees left on foot as reserves, not corresponding to the rules of the art of forestry, the end to be attained has not been reached. The clearing of contiguous cuttings necessitated a long delay until the sowings had well thriven before commencing to fell the next adjacent cutting; this delay of the clearing is often hurtful to the quality and the delivery of ripe wood, and very old trees liable to

deterioration ; all these inconveniences have disposed some foresters to adopt as their guide the scientific notions practised in other countries in the last century, and introduce the system of cuttings by alternate strips or belts which has rarely given satisfactory results for the reproduction or regeneration of forests. The introduction of natural methods of re-sowing by successive cuttings, first, to increase the production of seed, and afterwards, to shade the tender shoots during the period necessary to their development so as not to check their growth ; and last, the final cutting. This succession of regenerative cuttings, as well as meliorative periodical cutting, is very rarely met with in Russia, because the application of the method, perfectly reasonable in itself, of regenerating the forest by natural seeding, and at small expense, meets with serious obstacles in the custom of committing to the purchasers the whole care of the felling and the work in the forests.

It is impossible to exaggerate the pernicious influence that this practice exercises in Russia on the development of the art of forestry and sylviculture generally ; for the superintendence of the woodsmen pending the felling of the trees, and the field-work and dressing of the fallen timber by the purchaser who pays the axemen will always be defective and insufficient ; the forest-rangers of different grades cannot remedy this,—their influence and authority over the woodsmen are infinitely small, almost nil in everything that concerns the necessary care for the good order and conservation of the forests.

It is impossible to impose the conditions and exigencies of the art of forestry upon a man who exploits a forest that he has purchased to cut as quickly as possible, in order to profit by a speedy return of his capital. The absence in Russia of conducting all forest operations by the local directors or administrators of the forests, or by the proprietors themselves, explains the rare application of ameliorative cuttings, or periodical clearings so useful to the development of forest vegetation, whose fertility can only be achieved by a strict and constant inspection on the part of the directors, guardians or proprietors, well up in all the details of economic forestry. It is only by such labors so conducted that we can hope to see trees duly cared for ; that we can instruct workmen chosen from the people of the neighborhood to apply themselves to the different labors of the forest, and inculcate an appreciation and habitudes of forest management, without which forest depredations cannot be curtailed.

Natural regeneration of the forests, without cultivation, by seeding or young shoots, dominates in Russia ; artificial renewal by sowing or planting is practised in very few localities, only in those where by reason of exceptional economic conditions, forest management takes a more intensive character.

The planting of new forests in localities totally deprived of wood, has taken place principally in the steppes of Southern Russia, where, since 1842, its success

has been guaranteed by administrative measures. According to the reports of the Government Bureau of Forestry, artificial planting in the southern governments was as follows :

1866—	déciatines by seeding	2,088,	by planting	2,060
1867—	“ “	1,372,	“	1,400
1868—	“ “	1,317,	“	1,690
1869—	“ “	1,447,	“	2,303
1870—	“ “	255,	“	975

As regards the planting of forests by individual proprietors, there are few statistics ; relatively considered, it is known that large areas have been planted by certain owners ; Count Ouvarow, in the government of Moscow, 700 déciatines ; M. Schatilow, in the government of Toula ; M. Skarjinsky, in the government of Kherson ; 500 déciatines in the colony of the Mennonites in the government of Taurida ; and some others.

Ameliorative works, consisting in the construction or amelioration of forest roads for carrying off the timber cut,—the drying up or drainage of marshes—the encircling of forests by canals or live hedges, and the redemption of forest servitude (in Courland) have taken place in very limited proportions.

Conformably to the natural geographical distribution of the principal kinds of forests in European Russia (to the north, resinous woods prevail ; in the south, broad-leaved species), the management of the forests has also taken two different principal forms ; in the northerly and northern part of Central Russia, high forest and regeneration by seeding prevail ; in the southerly part of Central Russia, coppice-woods with regeneration by shoots predominate. The success of this last system of exploitation meets with a serious obstacle from the want of rigid regulations for the control of pasturage in the forests.

Composite exploitation, or by coppice under high forest, has penetrated without any preconceived plan, and only in isolated cases, in the region of black-mould lands, in the western provinces. Besides these principal forms of forest management, the application of other methods of exploitation is met with in the Russian forests ; rather of the soil than the forests. *Sartage* (not only of coppice, but frequently of lofty resinous varieties of trees), for the most part without any regular method, is found in the governments situated to the north and northeast, but is gradually disappearing. *Sartage* consists in allowing fields exhausted by the cultivation of flax or cereals, or soils poor by nature, or excessive cropping, to lie in fallow for a long time ; but in the long run they become covered with a woody growth whose roots penetrate the inexhausted sub-soil and promote a rapid vegetation. This accomplished, the peasants cut the wood, burn it on the spot because unsaleable, sow flax or wheat for some years on the soil enriched by the ashes, and when signs of exhaustion again occur, let it lie fallow again. This old method of working the soil is even now practised in southern and western Europe.

Traces of a more regular system of an alternative management, consisting in using the soil, one while as cultivated fields, and another while covered with varieties of forest growth, are observed in some parts of Central Russia, as in the district of Mojaïsk, government of Moscow; or, after a cutting has been cleared away, a crop of rye, oats, buckwheat and other economical domestic plants is taken off for two or three years, and the ground then reforested, by sowing, or more rarely by planting. The expense of reforestation is generally more than reimbursed by the benefits obtained from the cultivation of the soil during the intermediate time.

The system of periodically cutting the shoots from the roots of the willow and other trees is only met with in exceptional cases, and especially in places exposed to inundations, as the borders of rivers and lakes in the western and southern provinces.

WOOD IN CIVIL AND NAVAL CONSTRUCTION.

The varieties and dimensions of woods used in construction are multifarious. The choice of it depends on the quality in the surrounding country, and the facility of procuring it from distant localities where it is abundant. The inhabitants of the northern governments do not think much, for house construction, of beams, even of spruce or pine, less than twenty-one feet long and twenty inches thick. The people of central Russia do not reject spruce, nor poplar, nor birch, not more than seven inches in diameter and fifteen feet in length, but consider them good material for construction, and the inhabitants of the thinly wooded southern parts, willingly employ trees of not more than five or six inches in thickness by nine feet in length. In the government of Arkhangel and northern parts of Vologda and Perm, although the richest in forests, woods for construction purposes are not the object of any particular industry, or brisk interior trade, and are exclusively employed for local needs. But in all the other governments of Russia that are rich in forests, construction timber is a very considerable article of commerce, and is transported to other localities that have little wood or none at all, and to sea ports for foreign countries. The governments of Kostroma, Yaroslaw, Nijni-Novgorod, Kazan and Viatka supply timber by the Volga, the Kama, the Viatka and their affluents, and all thinly wooded countries situated on the lower course of the Volga, and those covered with steppes on the Don. The countries short of forests situated towards the mouth of the Dnieper are supplied with construction timber from Minsk, Mohilew, Orel, Tchernigow, and a part of Volhynia. Construction timber is sent to market in a rough and unhewn state, and even with the bark on it. It is only when logs are dispatched from distant regions by floating on rapid streams that they are dressed on two sides to secure more rapid transit. When construction wood is exported, it is hewn, with some exceptions as to pine, on two sides or full square, or by leaving

the sap-wood on the corners of the squared logs. Spruce wood is exported in very small quantities, and intermixed with pine. Oak logs for spicketing in quarter-deck and forecastle and wainscoting, are principally exported to England. They are hewn on three sides only to show that the wood is fresh and new, and not wind-fallen wood, or piled together for a long time. The largest quantity is shipped from Riga, coming from the governments of Mohilew, Minsk, and part of Volhynia. A small quantity is also sent by the port of Nicolayew.

The construction of river boats consumes an enormous quantity of wood. Each year about 100,000 boats of different dimensions navigate the Russian rivers. For the most part, these boats make only a single trip down the river, and no return voyage. On arrival at their destination they are demolished for firewood and building material. More than two millions of roubles* each year are expended for the renewal or completion of boats for river navigation. Pine and spruce are used for this purpose. The last mentioned is almost always used for the casing and lining of small vessels. When pine and spruce augment in price, poplar is used for bateaux, particularly in the governments of Mohilew and Minsk, for loading with firewood.

Wood used in the construction of sea-going ships commenced to be an object of interior trade about the year 1859, when the wood necessary for the construction of ships of war ceased to be delivered gratuitously from the state forests. The merchant fleet is not very largely developed in Russia, consequently the demand for wood in ship-building is not large. Since 1859 the Minister of Marine receives construction wood by the intervention of special agents, who purchase as much of it in the government forests as in those of individuals. The most massive woods for ship-building are found: pine, in the northern governments and in Novgorod, Tver and Orel; oak, in Minsk, Vilna, part of Kovno, and in Mohilew and Volhynia; also Simbirsk, Mitau and Kazan. Pine is exported from St. Petersburg and Riga. Larch for naval construction is exported in small quantities to London by the ports of Petchora, Mezene and Archangel. Oak is exported from Riga, Dantzic and Memel, by the Vistula and the Nieman. The greatest part of the oak coming from Volhynia is sent to Marseilles by the port of Nicolayew.

Straight trunks of trees of the best quality of wood, and the fewest knots possible, are used for sawing, at least twenty-one feet long, and twenty-two for export. Pine, spruce and broad-leaved trees are used in the interior for sawing; the last mentioned variety being principally employed in carpentry. Boards and laths of pine are principally used in the foreign trade; hardly any spruce boards being exported.

Sawing is done by hand, and also in saw-mills worked by water-power; but

* A silver coin of Russia equal in value to 100 copeks, and worth from about seventy-five cents to eighty-six cents, according to the coinage.

steam saw-mills have considerably increased in later years. There are about 100 large saw-mills in Russia; thirty driven by steam; six in the government of Arkhangel that are solely employed in sawing pine for export to England. Some of those driven by water-power, work for domestic use only, and turn out very small quantities; but there are thirty steam saw-mills and fifty water-power saw-mills that constantly ply for the foreign trade. In all these factories, two millions of trees, at least, are annually sawn. Sawing trees into boards, for local uses, most frequently takes place in localities where the forest is systematically exploited. The governments of Kostroma, Kazan, Viatka, and the southern part of Vologda, furnish with planks and boards those sparsely wooded countries situated on the lower course of the Volga and the countries on the Don. The governments of St. Petersburg, Olonets and part of Novgorod export planks and boards to foreign countries by the port of St. Petersburg, and furnish this city with saw-logs. In the northern parts of Vologda and Arkhangel, saw-logs, round and square, are sent abroad by the ports of the White Sea.

The elaboration of the rind of the young linden tree takes place principally in the governments of Viatka, Nijni-Novgorod, and in parts of Simbirsk, Tambow, and Penza. About 40,000 mats are annually exported from these governments, by the port of Arkhangel, to foreign countries. Linden fibre and mats are also manufactured in large quantities in the governments of Minsk, Mohilew and Vitebsk, from whence they are exported by the Baltic and Black seas, and the inland frontiers. About a million and a half are annually exported from these last mentioned governments. The quantity consumed in the interior is not known, but it may be stated, without fear of contradiction, that it far surpasses the export. The manufacture of mats is principally a domestic industry. Peasants, in their leisure hours, after their labors in the fields, macerate the rind, separate the fibres, and plait them into mats which are sold wholesale to commission merchants. In Nijni-Novgorod, Viatka, Kostroma and Minsk, this industry assumed the proportions of a small manufacture.

Linden trees twenty-five years old and over may be stripped of their bark for the manufacture of mats; when they are from five to ten years old their rind is used by a great many of the inhabitants of Russia in making their slippers and shoes. In localities where the linden is not so abundant as to satisfy all demands of this kind, it is replaced by willow or birch bark. The number of shoes (lapti) of the rind of the linden, willow, or birch bark turned out annually, may be estimated, without exaggeration, at a hundred million pair. About one-quarter of this quantity is made of birch bark, which is stripped from the tree at one-half of its growing age. Four stems of linden, seven feet long and about one and a half inches thick, are required to make each pair of slippers. Three hundred millions of young linden trees are thus employed in Russia annually in the manufacture of slippers and shoes.

RESINOUS PRODUCTS.

The *gemma* of pine for the purpose of obtaining white resin, and the distillation of old stumps and stems of pine so *gemmés*, constitute in certain localities in Russia the principal industry of the inhabitants. Among these localities there are many districts in the governments of Arkhangel, Vologda and Kostroma. Besides that, the peasants, in all localities where there is a sufficient abundance of pine, occupy themselves in the manufacture of tar, for their domestic wants. In the governments of the north which abound in forests, *gemma* is practised in the same manner as in the last century in the pineries of the Landes of Gasconne. The people *gemme* the pines to death in ten or fifteen years, during which time they carry off the liquid resin periodically, and afterwards cut the trees down.

The greatest part of the tar, as well what is used in the interior of the Empire as what is exported, is obtained in the simplest way, by digging a hole or pit in the ground for the purpose, where a small kiln is constructed, or a metallic pitch kettle, as in the governments of Vladimir and Riazan. More elaborate apparatus is seldom used. It is only in latter times that factories have been established, not only for the extraction of tar, but also to obtain pure products, such as spirit of turpentine, illuminating oil, resin, and acetic mordants. There are two such factories in the government of Kostroma, one in Mohilew, two in Vitebsk, two in Vilna, two in Minsk, and one in St. Petersburg.

It would be very difficult to determine the quantity of tar consumed in the country, because a very considerable part is made by the peasants themselves, for their own use, and escapes statistical observation. About 1,300,000 poods* of tar are exported to foreign countries. It is dispatched from the northern governments by the port of Arkhangel; from the north-west and those of Tchernigow, Kiew and Volhynia, by the port of Riga, and by Prussia.

In places where rosin is made, the peasants also extract from the exterior bark of the birch, the "diogot" or empyreumatic oil of birch bark, but in much less quantities and almost exclusively for use in the country.

Besides the above mentioned industries, practised in localities where wood abounds, the peasants busy themselves in making different kinds of wooden articles. The inhabitants of Nijni Novgorod, Kostroma and Viatka make enormous quantities of wooden spoons, from the aspen, maple and birch. These spoons are spread over almost the whole of Russia. There are no data showing the quantity manufactured; but if we take into consideration that all the peasants and most of the gentry use wooden spoons, and that each spoon does not last longer than a year, we may say, without fear of being mistaken, that there are not less than forty millions of spoons manufactured annually in Russia.

* 1 pood or 40 Russian pounds=16.38016-54808 kilogrammes; 100 pounds Russian=90.26 pounds avoirdupois.

In the governments of Kostroma, Nijni-Novgorod, Novgorod, Viatka and Perm, part of Vladimir and Tver, wooden utensils are made of the lime and aspen turned in the lathe. These replace common pottery, and delivered to the trade without being painted, or painted with different colors in oil, varnished and sometimes gilded, and in these forms, they give to a certain degree an idea of the station and fortune of the peasant. The export of these utensils has increased since 1851. A very large quantity of joiner's work is manufactured by the inhabitants of Viatka, Kazan and Nijni-Novgorod. These goods are dispatched to countries on the lower parts of the Volga and the Don. In Kazan, Saratow, Toula, Minsk, Vilna, Vitebsk, Mohilew, Grodno and Kovno, large quantities of different kinds of vehicles, chariots, sledges, pieces of cart-wright's works, wheels, naves, felloes, hoops, arcs for coach-shafts (dougas), are manufactured in large quantities. This manufacture takes place, but in small proportions, in every part of Russia, where wood of different kinds is used, but principally oak, birch, ash, maple and elm.

In latter times, poplar, which was considered to be a tree of very limited utility, has taken an important place in the preparation of paper pulp. There are several factories in Russia and Finland employed in grinding this wood by the hydraulic process. The low price of poplar wood, the facility with which the pulp can be bleached, and the considerable increase in the price of rags, promise a great future for this industry, all the more since the forests are rich in reserves of poplar, which renews itself in the forests of Russia without the co-operation of man. Different other species of white wood and also pine and spruce are used for the same purpose, but the quality of their pulp is inferior to that obtained from poplar. The total quantity of pulp manufactured annually in Russia may be estimated at \$2,408,000 kilogr. To produce eight kilogr of paper pulp, a cubic foot* of wood is required; but as about one-third of the wood is lost in dressing and splitting and is not manufactured, it follows to produce 2,400,000 kilogr. of pulp, there is an annual consumption of at least 12,500 cubic meters of wood, that is to say an annual increase of 4,000 hectares† of forest.

It is impossible without sufficient data to estimate with any exactitude the volume of trade in wood in the interior of the country, further than the quantity consumed by the wants of the inhabitants. The gross value of the wood consumed in the interior of the country may be estimated approximately in the following manner. For heating purposes, and the preparation of food for each family, there is required annually, on an average, a volume of forty-eight and one-half cubic meters or five cubic sagènes of wood; calculating the value of the sagène at two roubles, 120 millions of roubles will be required for twelve millions

* One cubic foot anglo-russe=28,31484 cubic decimeters. One sagène (in length)=7 English feet. One cubic sagène or 343 cubic feet=9,71199 cubic meters.

† 40 hectares=99 acres nearly.

of families. Consequent on the progressive increase of the population, about 80,000 houses for the peasantry are built each year; besides it may be estimated that 60,000 houses of this description are annually destroyed by fire. Calculating the average cost of constructing each house at 100 roubles, 14,000,000 of roubles would be required to construct 140,000 houses. For supplying fuel for 16,000 verstes* of railway, 2,400,000 sagènes (cubic) of wood are required; when lines of railway traverse countries that are not rich in forests, the value of each cubic sagène of wood used for this purpose may be estimated at three roubles; the consumption of railways therefore, amounts to the sum of 7,200,000 roubles; for the construction of boats for river navigation, two millions; for the active operation of mines and works, one and one-half millions of sagènes, annually, which, on an average of 1r. 50c. each, makes an expenditure of 2,250,000 roubles; for household utensils, furniture, fences, etc., 10 roubles, on an average for each family annually, 120 millions of roubles; the total value of wood consumed for the interior wants of the country amounts to the sum of 265,450,000 roubles. This may be considered a minimum figure, because the cost of transport of the wood from the forests to the places where it is consumed has not been taken into account, and also different uses of wood respecting which no statistics have yet been collected.

EXPORTATION OF FOREST PRODUCTS FROM RUSSIA IN 1871.

(1) *By the ports of the White Sea.*

Wood bark, 1,465 poods for.....	366 roubles.
Tar, 115,630 tons "	578,150 "
Agaric, 260 poods† "	130 "
Matting, 372,436 pieces "	55,865 "
Different wooden merchandise "	1,113,735 "
Total.....	1,748,246 "

(2) *By the ports of the Baltic Sea.*

Oil of birch bark, 95 poods for.....	95 roubles.
Wood bark, 271 poods "	68 "
Potash, 447,990 poods "	1,029,227 "
Tar, 578 tons "	2,890 "
Matting, 1,116,062 pieces "	167,409 "
Other wooden merchandise "	6,518,696 "
Total	7,718,385 "

* A Russian measure of length containing 3,500 English feet.

† The Russian word "goubki" as an article of export, includes agaric for dyeing, *Boletus obtusus*, agaric for tinder, *Boletus ungulae*; and the agaric of pharmacy, *Boletus laricis*.

(3) *By the ports of the Black Sea.*

Birch bark oil, 20 poods for.....	29 roubles.
Wood bark, 180 poods "	45 "
Spirit of turpentine, 15 poods "	37 "
Tar, 39 tons "	195 "
Agaric, 4 poods "	2 "
Matting, 342,715 pieces "	51,407 "
Other wooden merchandise "	127,390 "
<hr/>	
Total	179,096 "

(4) *By the European Frontier.*

Tar, 843 poods for.....	843 roubles.
Wood bark, 15,320 poods "	3,830 "
Spirit of turpentine, 95,133 p'ds "	237,834 "
Matting material, 117,944 pieces "	17,692 "
Wood charcoal, 35,442 tchetwerts* for.....	17,721 "
Other wood merchandise for.....	6,266,264 "
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Total	6,611,409 "

(5) *Exported to Finland.*

Tar, 1,564 poods for.....	1,564 roubles.
Matting material, 22,672 pieces "	2,289 "
Other wooden merchandise "	25,838 "
<hr/>	
Total	29,691 "

Among European States, Russia trades in wood with Sweden, Norway, Germany, Denmark, Holland, Belgium, Great Britain, Portugal, Spain, France, Austria, Italy, Turkey and other countries.

* The tchetwert=8 tchetweriks=64 garnits=209,896,832,777 litres=5.77 imperial bushels.

In 1871 she dispatched forest products to different States, of the following values :—

1 to	Great Britain	for.....	5,935,488	roubles.
2 "	Prussia	"	2,821,501	"
3 "	Holland	"	1,275,718	"
4 "	Other German States	"	806,917	"
5 "	Belgium	"	500,379	"
6 "	France	"	446,721	"
7 "	Sweden and Norway	"	138,976	"
8 "	Austria	"	116,733	"
9 "	Portugal	"	88,220	"
10 "	Turkey	"	58,727	"
11 "	Italy	"	26,203	"
12 "	Denmark	"	16,916	"
13 "	Moldavia and Wallachia	for.....	5,792	"
14 "	United States of America	for	1,516	mats.
15 "	Spain	"	30	"
16 "	Other European States	"	17,322	"

The forest industry in the north of Russia commenced to develop rapidly after 1871 consequent on the increasing requirements of the foreign trade.

The high quality of the larch-wood of the north of Russia commences, by degrees, to be appreciated in western Europe. There is no doubt now, that the slow growth of the Siberian larch, and beyond the Oural, gives to the wood more density, solidity and elasticity, than to the larch, which grows under the warmer and moister climates of western Europe. This circumstance may lead to a greater demand for Russian larch, of which there are vast exploitable masses, up till now intact in the countries situated between the Oural and the Petchora, and on the upper course of the Volga without speaking of the immense larch forests of Siberia.

EXPLOITATION AND REVENUE ACCRUING FROM THE FORESTS.

We have no positive statistics on the productiveness of the exploitation of the forests belonging to individuals, nor of the revenue derived from them. It may be said that, with very few exceptions, the exploitation of the forests situated in the central and southern governments exceeds their annual average increase. In the northern governments, abounding in forests, there is no apprehension that the cuttings increase out of measure, so long as the demands for wood do not increase, demands which, up to the present, are far below the productiveness of these forests. But the increase in price of the forest products, that augments the the revenue of proprietors, does not hurry them along to make excessive cuttings,

There are already some proprietors who have subjected their forests to regular exploitation. The grand forests of Prince Paskevitch in the governments of Moscow and Riazan, those of Count Oubarow in the governments of Moscow and Valdimir, of Prince Youssoupow, of Count Tolstoi, of Count Strogonow, of M. M. Scherémtyew, Demidow, Matzow, and other large proprietors are exploited before hand in the fixed proportions, according to plans of conservative management, which guarantee the existence of these forests; but this guarantee cannot be considered well assured, because it depends upon the ideas and personal tastes of future proprietors.

The forests depending on governmental administration are exploited in a less proportion than they might be, having regard to their extent. The cause may be attributed to their abundance in certain localities; to the insufficiency of a regular commercial demand; and the difficulties of transportation to distant consumers. Of the 120,941,327 hectares of forest dependent on governmental administration, excluding the forests of Poland and Finland, there are 101,811,000 hectares well stocked with trees. Over this extent 770 millions of cubic feet are annually exploited, which makes on an average 7,563 cubic feet, or 214.3837 cubic decimeters to each hectare. There are five governments where the quantity of wood cut relatively exceeds by ten times this average figure: in the governments of Moscow 79 feet or 2.13728 cubic meters: of Kalouga $141' = 3.98$: of Toula $112' = 2.16176$ c.m., of Voronega $115' = 3.24645$ c.m., and of Tambow $96' = 2.695$ c.m. per hectare. In the governments of Courland, Koursk, Kherson, Ekaierinslaw, Podolia and Bessarabia, they cut annually from 50 to 75 feet, or 1.416 to 2.124 cubic meters per hectare. In twelve governments:—St. Petersburg, Kozan, Simbirsk, Esthonia, Livonia, Smolensk, Soratow, Riazan, Penza, Orel, Kharkow and Astrakhan, they cut 25 to 50 cubic feet, or 0.708 to 1.416 cubic meters per hectare. In twenty-one governments:—Novgorod, Tver, Yaroslaw, Vladimir, Kosiroma, Viatka, Nijni-Novgorod, Pskow, Vitebsk Kovno, Vilna, Grodno, Mohilew, Tchernigow, Volhynia, Kiew, Qufa, Orenburg, Tambow and Tourida, they cut from 10 to 25 cubic feet or 0.2832 to 0.708 cubic meters per hectare; finally, in the northern governments:—Arkhangel, Olonets, Valogda and Perm, they cut annually less than 10 cubic feet of wood, or about 0.2834 meters per hectare; particularly in Olonets 7.6 c. ft. = 0.215 c.m., in Perm 6 ft. = 0.17 c.m., in Vologda about $2\frac{1}{4}$ c. ft. = 0.0708 c.m. and in Arkhangel 1 c. ft. = 0.02734 of a cubic meter. Consequently there are only five governments where the proportion of exploitation approaches the annual growth, in all the other governments it is well below the normal growth, and in the northern countries it scarcely reaches 2% of the annual average growth without the least culture.

The proportion of annual felling in the state forests is regulated by estimates drawn up each year for each forest specially, and confirmed by the Minister of State domains. With the exception of certain cuttings, whether with financial

aid, or gratuitous, which the exigencies of the government require, all the remainder is sold by auction. The price by auction is fixed on the basis of the valuations, drawn up each year, of each particular forest confirmed by the Minister of Domains. The auction starts with the valuation figure. Sales are not made without auction, excepting in localities where there is no competition. The forests are sold at the rate of so much per quantity and volume, or by number, the diameter and length of the pieces of material purchased, or by area at so much per déciatine* after taxation and estimate of each area.

The forests are sold on the stump, and the purchaser is bound to cut them and clear away the cutting within a fixed time. There are only a few forests, seven altogether, where the forest agents themselves are charged with all the supervision of cutting, the working, the sale of the trees, and clearing off the timber, and the restocking of the ground cut over. This method of procedure is remarkably advantageous, as well as regards the pecuniary profit, as the systematic management of the forests; but unfortunately the immense extent of the forests, and consequently, the very complicated occupations of the forest agents, have not, until now, permitted them to operate the sale of cuttings in general by this method, nor to extend its application on a larger scale. In the forests allotted for the maintenance of mines and their uses, they cut on an average each year 32 cubic feet or 0.905 cubic meter per hectare. Although the greater part of these forests are situated in the northern parts of the country, on productive soil, nevertheless, the proportion of their exploitation scarcely reaches one-half of their average annual growth.

The value of all the forest materials accruing from the felling of the state forests amounts to the sum of 8,512,500 roubles. But as the peasants and soldiers on the domanial lands are apportioned the wood necessary for their domestic wants at half price, and as wood is delivered gratuitously for certain state uses, and public services, the consequence is that the forest revenue is below the figure above mentioned, and amounts in reality in the chest to about 6,386,000 roubles.

If to these figures we add the revenue accruing from rents (for arable lands, meadows, fisheries and the chase) which constitute five per cent. of the revenue; the costs and damages for illegal cutting, about nine per cent. of the total revenue; and lastly the pasture of animals, the profit from the harvesting of seeds and berries; the raising of bees in the forests etc., which further make up two and a half per cent. of the total revenue; it is found that the total gross revenue of the state forests amounts to the sum of 9,850,000, which make on an average 9.6 kopek,† or 38 centimes per hectare. This revenue is derived from the govern-

*One déciatine=109.24881349574384 ares.

One are=1 square decametre=119.60333 square yards.

†.00 kopeks=1 rouble.

ments in an extremely unequal way. In the governments of Arkhangel, Olonets, Valogda and Perm, they receive $1\frac{1}{2}$ kopeks or 7 centimes per hectare of forest; in the governments of St. Petersburg, Novgorod, Tver, Yaroslavl, Vladimir, Kostroma, Viatka, Nijni-Novgorod, Kazan, Simbirsk, Esthonia, Livonia, Courland, Pskow, Smolenok, Vitebsk, Kovno, Vilna, Grodno, Minsk, Mohilew, Tchernigow, Volhynia, Samara, Tambow, Oufa, Orenburg, Penza, Orel, and Taurida, the average revenue is 22 kopeks or 88 centimes per hectare; in some governments it is 45 kopeks or one franc 80 centimes. In Riazan, Kiev, Kalouga, Koursk, Kharkow and Astrakhan the revenue amounts to 80 kopeks, or 3 francs 20 centimes per hectare; in the governments of Moscow, Voronega, Ekaterinoslaw and Podolia, the revenue amounts from 117 to 157 kopeks, or 4 francs 76 centimes to 6 francs 28 centimes per hectare; in Bessarabia and Kherson, from 210 to 240 kopeks, or 8 franc 4 centimes, to 9 francs 60 centimes; in the government of Toula to 500 kopeks, or 20 francs per hectare.

The revenue of the forests, allotted to mines and works of the state, amounts to 1,160,000 roubles, making on an average $23\frac{1}{2}$ kopeks, or 94 centimes per hectare.

The gross revenue from the state forests settled upon younger sons, amounts on an average to 1,086,000 roubles, making $11\frac{1}{2}$ kopeks or 46 centimes per hectare.

In the ten governments situated on the Vistula, the forests of the Kingdom of Poland give 14 kopeks or 56 centimes per hectare, in the government of Sedletsch, and even to 218 kopeks or 8 francs 72 centimes in the government of Lubin. The ten governments situated on the Vistula give together a total annual revenue of about 262,000 roubles.

The total gross revenue of all the forests of European Russia, dependent on governmental administration, exclusive of the forests of the Caucasus, and those of the Grand Duchy of Finland amounts to the sum of 12,358,000 roubles.

The cost of administering the state forests, exclusive of appanage forests, those of mines and works, and those of the Kingdom of Poland, amounts to 4,380,000 roubles, or 44 per cent. of the gross revenue.

The costs include the following heads:

The maintenance of the personnel of the Directors of the forests,	
and the forestry agents, the maintenance of establishments of education, and the construction of houses for forest agents and guards.....	
	3,090,000 roubles
For drawing up plans of management, and for ameliorations in the management of the forests.....	
	740,000 r.
Payment of the territorial tax or impost.....	
	55,000 r.
Total	
	<u>4,380,000 r.</u>

ADMINISTRATION OF THE FORESTS.

The administration of all the State Forests of Russia in Europe, exclusive of the Caucasus, those of Finland, of mines and works, of appanages, and of the Kingdom of Poland, is concentrated in the hands of the Minister of State Domains, and forms a separate Department. The administration of the forests, of mines and works and those of the Kingdom of Poland is entrusted to the hands of the Minister of Finance. The appanage forests are administered by the sovereign and his council. The Caucasian forests are under the administration of the Viceroy of the Caucasus; and those of Finland are administered by a special bureau of forestry in Finland.

At the head of the administration under the immediate control of the Minister of State Domains, there is the Director of the Department of forestry, having for his assistants a vice-director, and seven chiefs of division, among whom all the labors of the different branches of administration and forestry management are distributed. To aid the director in superintending the regular march of affairs upon the ground, and the inspection of the forests, there are six vice-inspectors. There are moreover twenty specialists in the department of forestry employed for different missions relating to the forests, and one hundred and ten taxers occupied solely with the organization of the forests, elaboration of plans of management, and revision of forestry organization. In those governments or provinces where there is a superior officer (master of government forests) at the head of administration: he is at the same time, a member of the provincial administration of the State domain, and in those provinces where the forests constitute the most important part of the State domain, the government officer is chief of the administration.

To assist the employé of the government forests in the immediate superintendence of the movements of the affairs of the forest, he has from one to five controlling agents, according to the extent of the province, and the quantity and importance of its forests. Each province in affinity with the administration of the forests is divided into districts. Their number in each government depends on the quantity of the forests, their dispersion over the whole extent of the province, and their financial importance and general economy. There are 479 districts or forest rangerships in Russia. These districts are arranged in four classes according to their importance and extent. The forest districts of the three first classes are managed by the forest officers; the districts of the fourth class are managed by sub-foresters who have finished their course at the school of forestry of Lisino. In each district there are one or more assistant agents according to its extent. For the immediate guardianship of the forests there is a body of guardians under free or voluntary contract. In forests conceded to village communities, the guardians are taken from the peasants themselves, receive a fixed

salary, and are paid by the common council. Chief foresters in the provinces receive a salary of 2,000 roubles, and from 400 to 600 roubles travelling expenses.

A forest overseer receives a salary of 1,200 to 1,500 roubles, and from 200 to 600 roubles for travelling expenses.

Foresters of the first class receive 1,500 roubles, those of the second class 900 roubles, those of the third class 600 roubles, and those of the fourth class 300 roubles. Each forest agent receives from 200 to 400 roubles annually for travelling expenses, and from 200 to 250 roubles for other expenses. Besides, each forester receives a domicile from the State in a forest-keeper's house, or rents one in the town or village nearest the forest; and is allowed fuel for his quarters, and thirty deciatines of arable land.

An assistant forestry agent or sub-forester receives an annual salary of 240 roubles, and fifteen deciatines of arable land. Forest guardians are paid at the rate of 60 to 200 roubles per year; they have lodgings at the expense of the State, fuel and one and one-half deciatine for a kitchen garden.

The government of Courland is not included in these general regulations for the remuneration of employès of forest administration. Local forest administrators and guardians in Courland do not receive a salary: they are lodged at the expense of the State, are provided with fuel, and land for farming purposes, and receive five per cent. of the revenue obtained from the sale of forest products.

INSTITUTIONS FOR INSTRUCTION IN FORESTRY MANAGEMENT.

To prepare young men who desire to occupy places as forest agents, as well in the State forests as in those belonging to individuals, there are two special schools for superior education; the Agricultural and Forestry Institute at St. Petersburg, and the Agricultural and Forestry Academy of Petrowski at Moscow. The term of study in these two establishments lasts for three or four years. After finishing their course, the pupils leave the establishments with the rank of graduate, or candidate. There are two forests in the neighborhood of the Academy of Petrowski for the practical study of forestry; one containing 257 hectares and the other seventy-three hectares. The students of the Institute of St. Petersburg take practical lessons in the forest of Lissino, belonging to the State, situated about seventy versts* from the city, and containing 30,000 hectares of forest.

Besides these two establishments, there is a school of the second class in the Village of Lissino. The pupils leave this school with the rank of forestry conductors, and take the places of assistant forestry agents, and forestry agents of the fourth class. The course of practical studies at this school of forestry is for three years.

*1 verst=3,500 English feet, 3 verst=2 miles nearly.

ADDENDA.

*Gemmage, or how to extract liquid resin from the pine by incision, also rosin and spirit of turpentine, according to the method practised in the country around Bordeaux.**

There is no province in France that furnishes so many different kinds of pine resin as the province of Guienne. This tree grows chiefly in arid and sandy soils, such as the Landes, which extend along the sea, from south to north, from Bayonne into the region of Médoc; and on the other side, from the shore of the sea to the banks of the Garonne. Throughout this whole extent, there is commonly known only one species of pine, to wit, the pine of Lobel, or the maritime pine of Dodonée.

When the pines have attained four feet in circumference, a notch is made at their foot, near the roots, three inches wide and seven or eight inches high; the rough outer bark is first taken off with an ordinary axe, then the inner bark and a shaving of wood are removed with a very sharp adze; the wound is freshened from time to time with this instrument, so that it attains one foot in length in the course of a year. This incision is continued, a foot higher in the following year, and so on in each succeeding year, until it has reached the height of seven or eight feet.

In the eighth year, whilst the notch exudes a resinous gum, a new notch is begun at the foot of the same tree in a line parallel with the first. When this new incision begins to furnish a resinous gum, the old one cicatrizes, or heals over, so that in this manner many turns or revolutions may be made of a pine, because, in this succession, new notches may be formed on the old scars themselves, especially when the workman who makes the notches knows how to manage the tree properly, by removing very thin shavings each time he refreshes the wounds; for the gum always runs more abundantly from recent than from old notches; moreover, the thinnest chip is sufficient to permit the resinous gum to exude. The labor exacts activity; for the task of one man is usually two thousand five hundred or two thousand eight hundred feet of trees, distant from one another from twelve to fifteen feet; and this labor becomes much more toilsome when the notches are above the reach of the axe; for then the workman is obliged to lift himself up. He places one foot on one of the notches and clasps the tree with the other leg and one of his arms, whilst with the other he brings down the axe on the pine he wishes to cut.

From the month of May until the month of September the resinous gum

*Taken from the memoirs of M. de Caupos, of the Academy of Bordeaux, as published by M. Duhamel Du Monceau, of the Royal Academy of Science, in the year 1755.

exudes in a liquid form, and trickles into little wooden tar buckets placed at the foot of the trees to receive it, it is called *galipot*, and may be regarded as a sort of pine terebinth.

The gum which exudes from the trees from the month of September till the month of May, coagulates along the notches, where it forms a white crust similar to tallow or wax when hastily cooled. This crust is detached with an iron instrument like a rake or Dutch hoe, with a wooden handle. This thick gum is called (*barras*) resin, and is mixed with the *galipot* in the manufacture of resin.

Apart from these incisions, there are drops of resin that issue naturally from the bark of pine trees and dry up and form grains, and used occasionally for adulterating the incense of the Levant. As this extravasation comes from pines especially when near their decay, it is the last product of those trees that age has enfeebled, and that the notches have exhausted and dried up. To make resin, the *galipot* and coagulated juice are boiled in large copper kettles whose edges are turned over two or three inches; these kettles are built in brick furnaces.

When the resinous juice is sufficiently cooked it is filtered through a straw bed as practised in Canada; then run into moulds dug in the sand. To make a better quality, a spout or gutter six or eight inches long is fixed on the side of the kettle, and near the furnace and under the spout of the kettle there is a hollow trough dug out of pine, and filled with water; the workman pours this water by degrees into the kettle where the resinous juice has been melted, and part of it flows over through the spout into the trough.

The workman continually takes up the resin that falls into the trough, and puts it back again into the kettle, he stirs and mixes all of it well together, so that the resin, which is continually mingling with the water, changes color. If care is taken to keep up a steady and uniform heat continuously, and not to interrupt the circulation between the spout and the kettle, the resin becomes almost as yellow as wax.

When the resin has acquired this color, and is well cooked, it is filtered through straw in another trough, whence it goes into moulds made in the sand to be made into cakes. The contour of the moulds is traced with a forked stick that serves as a compass. The sand is cut with a knife, taken out, and the sides and bottom beaten with a wooden mallet, formed in a proper manner and of equal dimensions, so that all the cakes of resin will be nearly of equal weight. According to the quality of sand in which the moulds are formed, the cakes have a more or less favorable appearance, and are more or less readily sold.

The filtering straw, all leaves and pieces of wood imbued with the gum resin are made into lamp-black, or used for heating in the furnaces, but in the neighborhood of Bordeaux, all matters charged with resin are burned in the furnaces, and according as the fire is kept up, or the furnaces more or less heated, a resinous

matter is obtained more or less black, or more or less hard, and packed in barrels for sale. This quality of rosin is called, although improperly, black-pitch.

The galipot, or liquid matter, that exudes from the pines in summer, may, when not thickened by boiling, be placed in the class of terebinths. The firs, properly so called, are, as is well known, the only trees of the forest, that furnish good and true terebinth; larches also supply it, but the quality is not so good; and the pines supply some also as has just been described, but it is very inferior to that of the larch. Besides the odor, taste and transparency which distinguish, these different terebinths, there is still another property that characterizes them; that is, the facility with which they coagulate. The fir preserves its liquidity better than all the others, and the resinous juice of the pine loses it most readily.

Upon the question whether the wood of the pine from which the rosin has been extracted, is good for all purposes, opinion is divided; but the majority assert that the wood is still very good, and the extraction of the rosin does not injure its quality.

It may be remarked that scarcely any forests that can be planted are more advantageous to the proprietor than those of the five-leaved pine. This tree will flourish in sands, where nothing else will grow. It is a fast grower, especially in lands it likes. Poles for the hops and vine can be made from it after ten years, and when fifteen or eighteen years old, it can be cut for firewood. By taking the precaution of barking the wood, and letting it dry for two years, it has almost no offensive smell. The piled bark may be used for tanning. When twenty-five or thirty years old, it begins to supply rosin; if the notches are carefully managed, it may, after having yielded a profit for thirty years, be cut down for carpentry; in many provinces it is sold for two-thirds the price of oak; the trunks, the roots, and all the fatty parts of the tree, supply tar and charcoal.

Pines are in full vigor at sixty and eighty years, and the oak at one hundred and fifty, to two hundred years. It may therefore be concluded that pine high forests are more advantageous to proprietors than those of oaks, not only because they may be cut twice as against once, but also because high pine forests produce a very considerable annual revenue. It is surprising that the owners of sandy plains do not think of planting them with pines, that require very little expense. A father of a family could not make a more profitable investment for his children.

INDUSTRIAL RESOURCES.

The industrial resources of a country are the foundations of its wealth, and their development contributes largely to the prosperity and contentment of its people. Every one knows the importance of the arts in social life, in industrial progress, and particularly in the extension of trade.

The multifarious uses of wood in every day life are familiar to every observer. The products of the destructive distillation of wood are marvellous. The ash

left on combustion of wood may amount to as much as five per cent. of the weight of wood burnt, or fall as low as one-half per cent. ; a little over one per cent. is about the average.

This ash contains potash, soda, lime, and magnesia in large quantities, chiefly in combination with carbonic acid, phosphoric acid, or sulphuric acid ; also in smaller quantity manganese, iron, potassium chloride and silica.

Some recent experiments carried out by A. Jakowleff give the following results as to the percentage of acetic acid yielded by different woods :

Linden	10.20	Fir	5.16
Birch	9.41	Birch bark	2.29
Aspen	8.21	Cellulose, }	6.21
Oak	8.08	from birch }	
Pine	5.89	Cellulose, }	5.07
		from pine }	

These numbers support the common opinion that conifers give a smaller yield of acetic acid than other woods. They also indicate that lignin is very productive, and that hard woods should be better than soft, although an exception to this occurs in the case of linden.

The products of distillation may be classified as follows :

(1) *Non volatile residue*—Charcoal (ash).

(2) *Volatile distillate*.

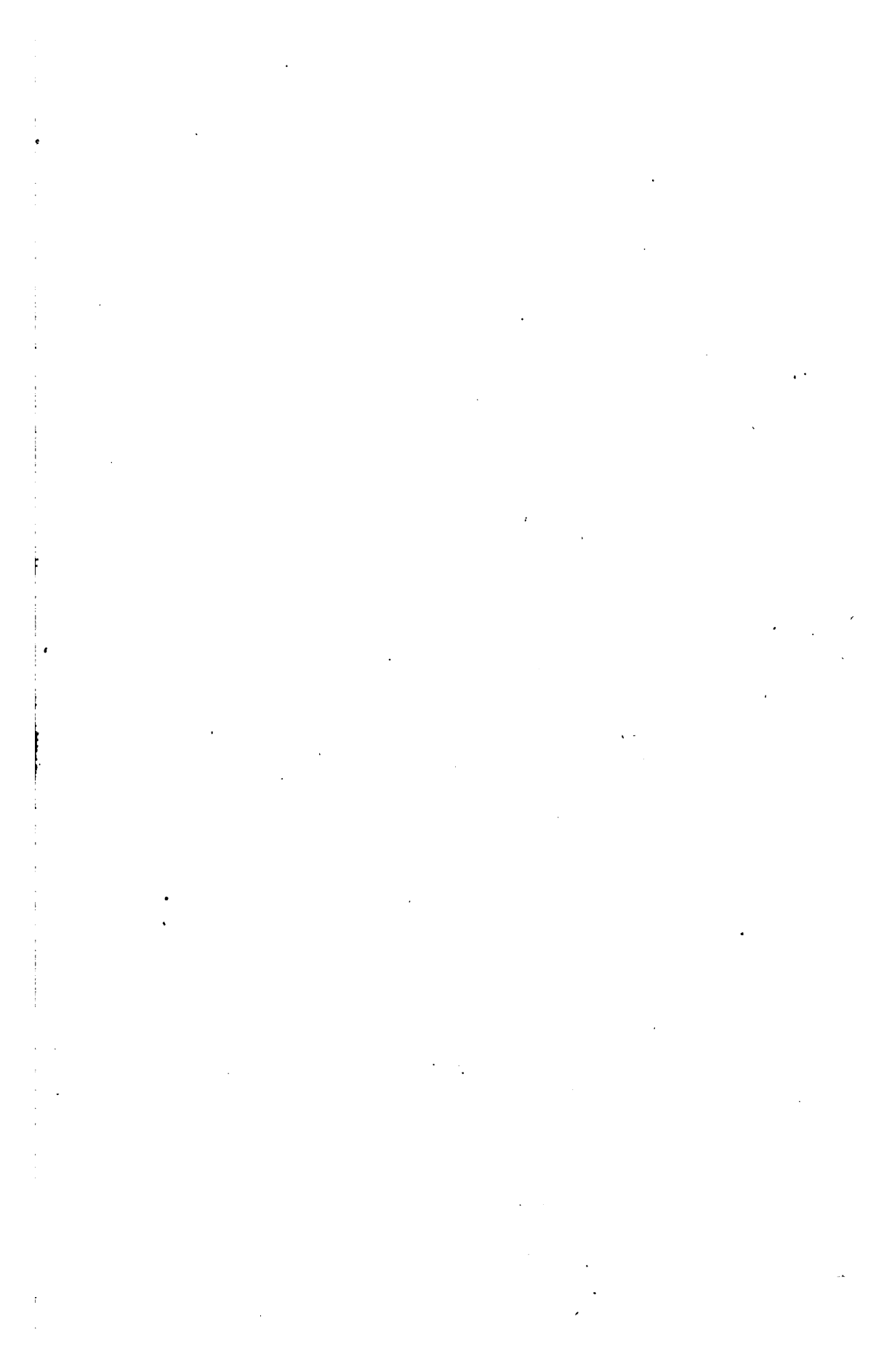
(a) *Condensable*—Water, pyroligneous acid, propionic acid, acetone, wood spirit, tar oils, tar, benzene phenol-guaiacol, cresolphorol, creosote, naphthalene, and paraffin.

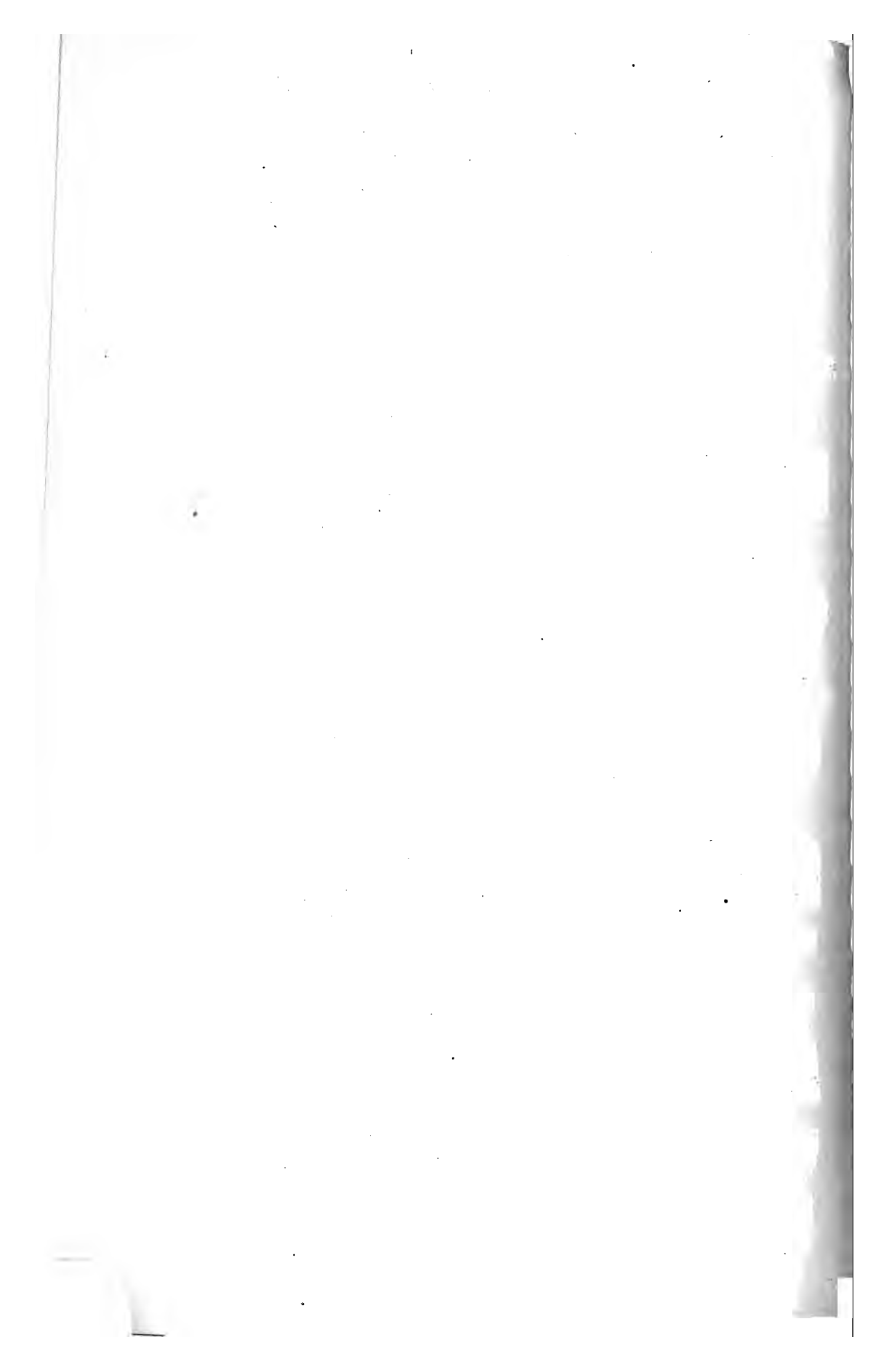
(b) *Uncondensable*—Carbon monoxide, carbon dioxide, hydrogen, methane, ethane, acetylene, etc.

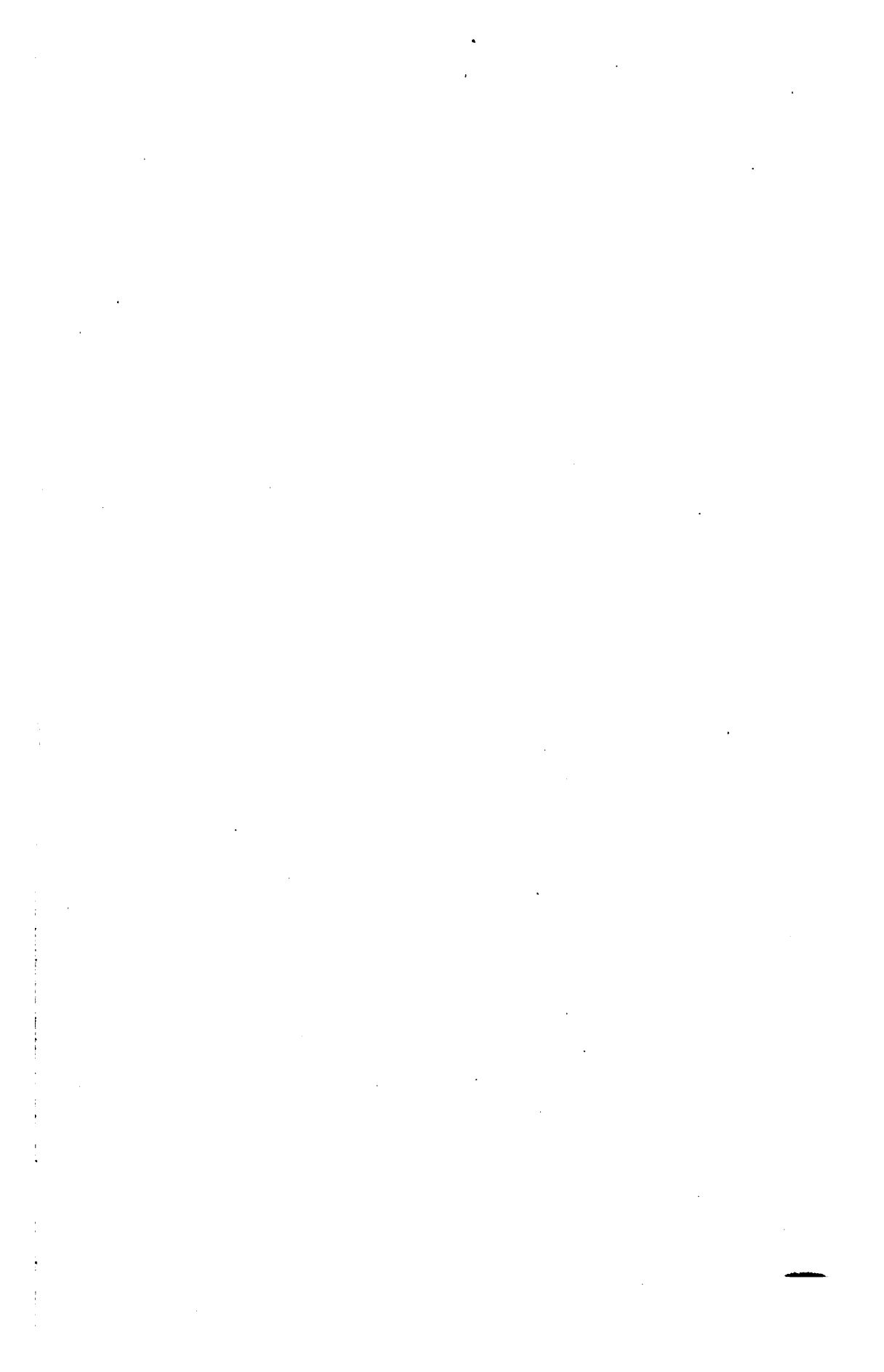
The wood tar, and tar oils contain, amongst other products, iridol, citriol, rubidol, coridol, benzidol, benzene, toluene, xylene, cumene, eupion, creosote, mesite, xylite, paraffin, naphthalene, chrysene, pyrene, retene, pittacal, picamar, colophony, and resins.

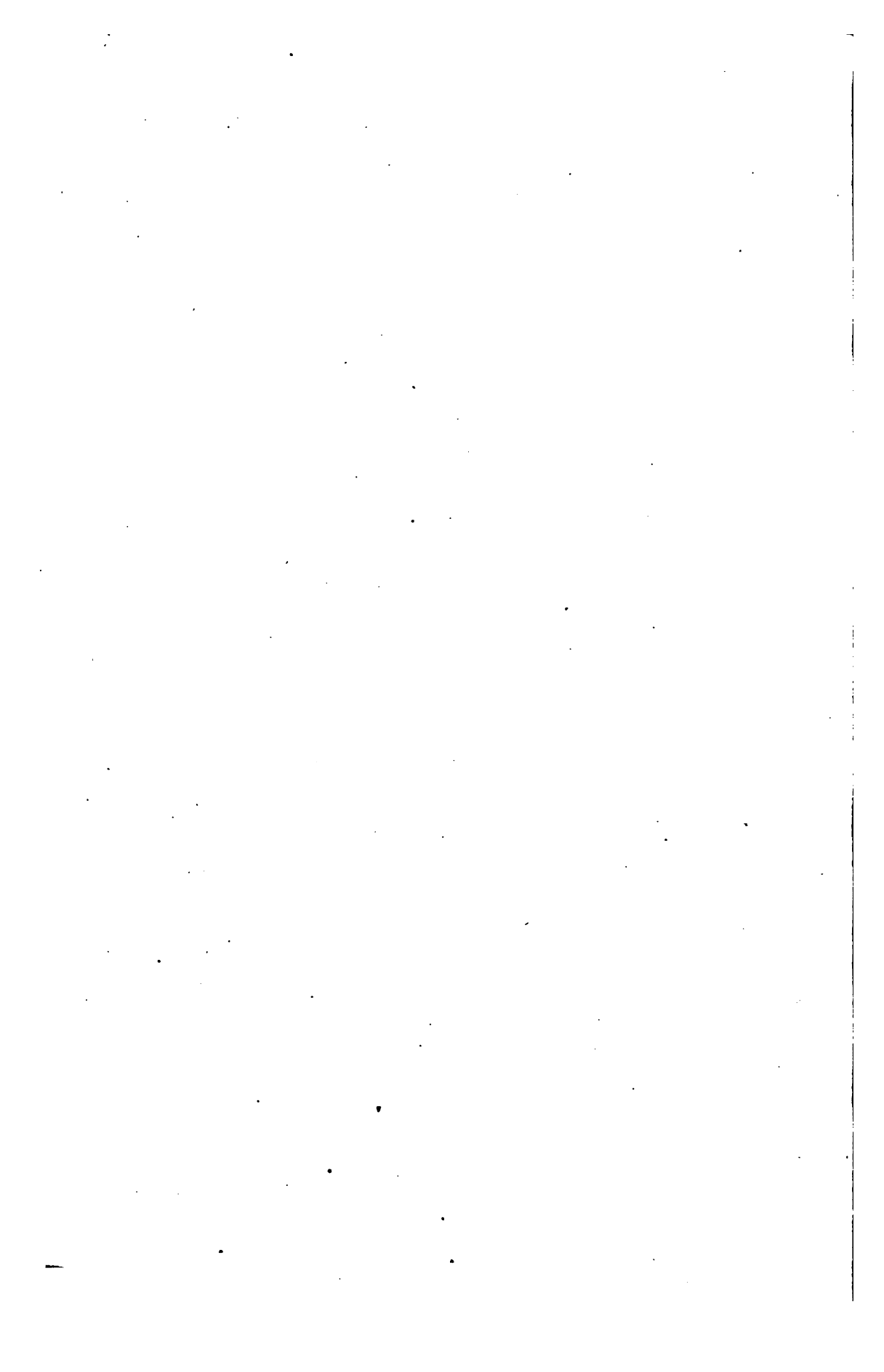
The relative quality and quantity of these products depend also very largely on the temperature at which the distillation is conducted and the time occupied in the process.

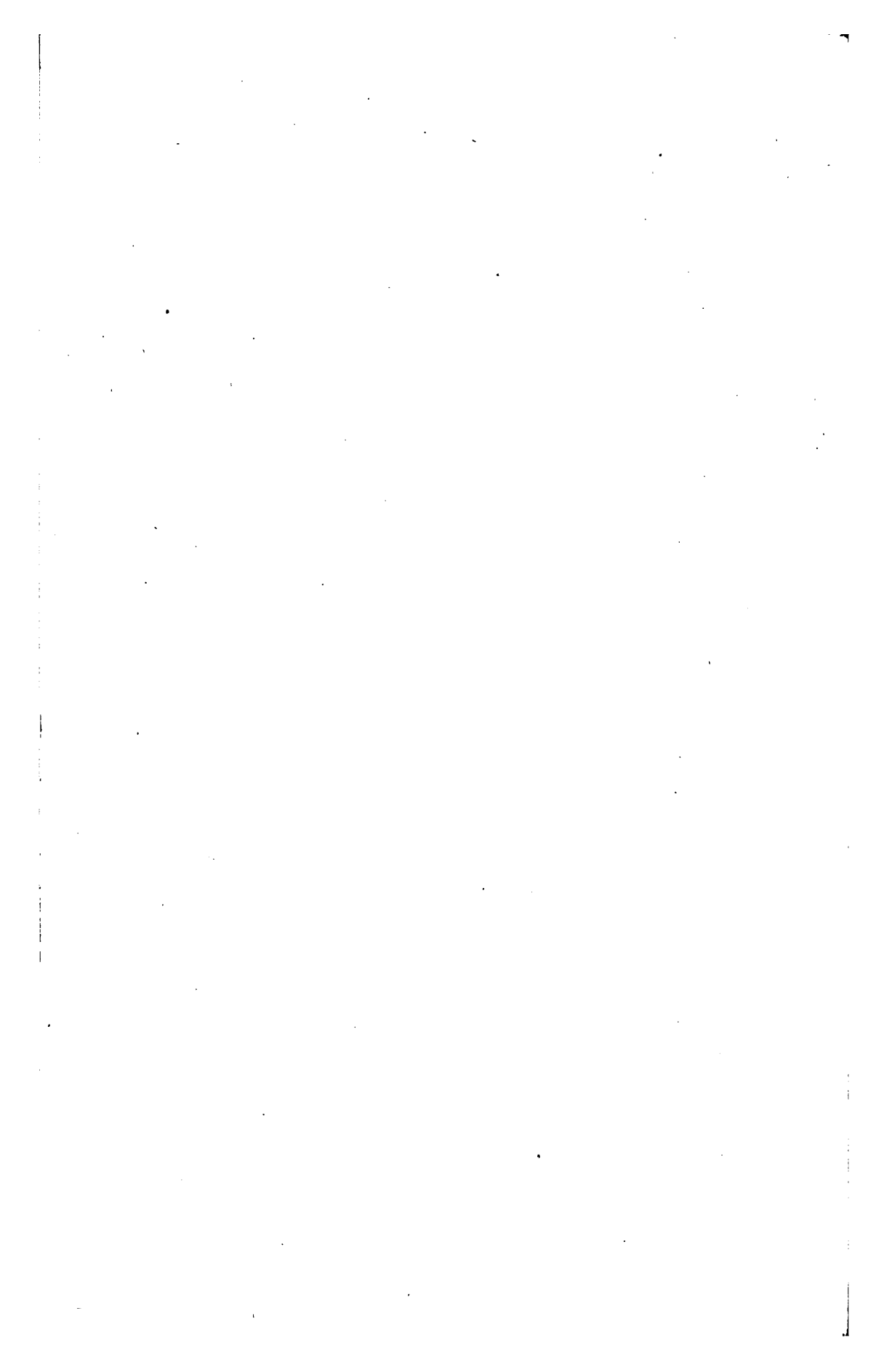
“O Nature ! how in every power supreme !
Whose vot'ries feast on raptures ever new !
Oh for the voice and fire of Seraphim,
To sing thy glories with devotion due !”













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